

"Clarke teaches that the nanotubes are present in an amount of 0.1-50 mg/mL (0.01-5 wt%), preferably 10 mg/mL (1 wt%) (col. 6, lines 31-35)."

It appears the examiner has misinterpreted Clarke's teaching. At column 6, Clarke teaches only about the **concentration of emulsifying agents and not to the concentration of carbon nanotubes**. In particular, Clarke's column 6 is directed to dispersal agents, and that teaching starts at column 4, line 66 and ends at column 7, line 21.

The concentration of the carbon nanotubes is referred only at column 7, lines 22 to line 33. Clarke actually wrote, the nanotubes maximal concentration is defined "as high as 1 mg/ml" which according to the applicant (and the examiner) is as high as 0.1 wt%. This misunderstanding is comprehensible and results from Clarke's relatively unclear language of the considered passages, and it will be discussed in more detail further below.

The instantly claimed suspensions are superior to Clarke's diluted suspensions, and comprise by at least 400% more carbon nanotubes (the instant minimal concentration of 0.5 wt% compared to Clarke's maximal concentration of 0.1 wt%), enabling the nanotubes concentrations one hundred times higher than Clarke. The instant method substantially differs from the published one, and is therefore novel.

4. The above fact notwithstanding, the Examiner's kind attention is directed to the fact that claim 9 was acknowledged by her in her last office action as novel, and since the novel subject matter of claim 9 has now been incorporated into claims 1 and 12, amended claims 1 and 12 are novel, as well as all dependent claims, the rejection under 35 U.S.C. §102 is now moot.

Claim Rejections – 35 USC §103

5. Claim 9 was rejected under 35 U.S.C. §103 as being unpatentable over Clarke (US 6,878,361).

The Examiner acknowledged that sonication is not taught by Clarke for dispersing the nanotubes, and so claim 9 is acknowledged as novel. However, stating that it would have been obvious to use sonication in connection with Clarke's technique, the Examiner mentions the same arguments used by her in regard to the rejection under 35 U.S.C. §102 (paragraph 5 of her letter, and paragraph 3 above of the present letter).

Firstly, the applicant notes that, although both Clarke and the instant technique has the same goal of dispersing the carbon nanotubes at highest possible concentrations, the two techniques are entirely different in their attitudes, in their technical means, and in their achievements.

Clarke approaches the nanotubes as a "biological" species, and aims at their dispersing in an aqueous solution with a biologically active dispersal agent (column 4, lines 29-34 and column 13, line 24), which can be dispersed by any detergent at certain concentrations relative to their CMC values (Example 1, lines 36-39 at col. 6); the nanotubes are added to concentrations of 0.02 wt% (Example 4), and "as high as" 0.1 wt% (lines 31-32 at col. 7, Examples 1-3), wherein the detergent to nanotubes mass ratio may be 500 or more (column 6), while the HLB values of the detergents should be from 7 to 13.2 (column 6, lines 49-50).

The instant technique approaches the nanotubes as an integral part of nanotube/polymer complex, and relates to the interactions within the ternary system

nanotubes/polymer/solvent; the critical feature is employing a block polymer together with a solvent selective toward the blocks of the polymer. The system is not limited to an aqueous system. These means provide stable suspensions of nanotubes at concentrations as high as 10 wt%.

6. Careful reading of Clarke shows that columns 4 to 7 relate to dispersing the nanotubes by using "biologically active dispersal agents" (column 4, lines 32-34). The usable agents are defined at column 5, lines 30-51, and they comprise all the surfactants used in biology, including soaps like SDS, nonionic detergents like TWEEN, quaternary ammonium salts, deoxycholates, cyclodextrins, and included are even the chaotropic agents like urea and guanidine. The paragraph starting at column 5, line 52 deals with cyclodextrins and taurocholic acid, and defines their concentrations as from 5 to 500 mg/ml in the last sentence:

Typically, cyclodextrin and doxycholates may be utilized to suitable disperse SWCNT structures according to the present invention in concentrations ranging from about 5 mg/ml to about 500 mg/ml of aqueous solution, with a preferable concentration of about 50 mg/ml.

That passage evidently relates to the detergent concentration and not to the nanotubes concentration.

The following passage, starting at column 6, line 24, relates to saponin, and again defines its concentration in the last sentence:

Solubilization of raw SWCNT material has been achieved at concentrations between 0.1 mg/ml and up to 50 mg/ml of aqueous solution in the present invention, with a preferable concentration of 10 mg/ml.

Although it may seem unclear whether the concentration relates to the detergent or to the nanotubes, the comparison of the saponin-passages with the previous cyclodextrin-passages clearly shows that the intention is always to relate to the detergent. Also the following passage, starting at column 6, line 36, relates to the detergents.

Only the passage starting at column 7, line 22 relates to the carbon nanotubes and their concentrations:

...effective dispersions have been achieved utilizing concentrations as high as 1 mg/ml of SWCNT structures in aqueous dispersal agent solution.

The above quotations confirm that Clarke does not teach high nanotube concentrations, as believed by the Examiner, and that the two techniques are essentially different. It might seem to the Examiner that the instant invention was within reach, because Clarke mentioned all detergents, and because Clarke was believed to reach high concentrations; however, the above explanation shows that instant extremely high nanotubes concentrations were never reached before the present invention, although desired; a person skilled in the art could not have deduced from Clarke's aqueous system, employing any detergent at high concentrations (50-95% of CMC, col. 6), the instant block copolymer and a solvent selective to the blocks.

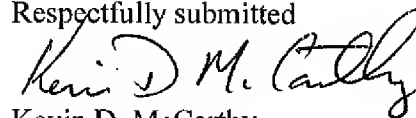
Although Clarke recites some block copolymers in his list, their potential cannot be realized, because they are not mentioned together with the selective solvents, and secondly they are not shown to have any special effect different from any other mentioned material; the absence of efficient sonicating in the prior art notwithstanding. For example, Poloxamer 188 is mentioned as possibly being used as a secondary dispersal agent, to replace cyclodextrin which is considered to be the main, and better dispersal agent (column 8, lines 1 to 19). The comparison with other detergents does not teach any special properties of Poloxamer (Fig. 1-2). As already mentioned in their previous response, the applicants note that Poloxamer 188 has an HLB value of at least 25, and therefore would not conform to the Clarke's acceptable range of 7-13.2 anyway.

7. It is clear, from the explanations above, that a person skilled in the art would not have deduced from Clarke's teaching that a block copolymer in a fluid selective toward at least two blocks of the copolymer will disperse carbon nanotubes, when sonicated, to 100 times higher concentrations than achieved by Clarke.

Conclusion

It is respectfully submitted that, after the above explanations and amendments, the claims are ready for allowance.

Respectfully submitted



Kevin D. McCarthy

Reg. No. 35,278

Roach, Brown, McCarthy & Gruber, P.C.
1920 Liberty Building - 424 Main Street
Buffalo, New York 14202
716-852-0400